

# **SERVICE MANUAL**

**REMOTE CONTROL OPTIONS**

**MA-158, 159, 160, 161, 162**



There has been some confusion as to the use of Regency Remotes, especially with respect to use with ACTION-CALL. All Regency Remote Control Consoles may be used with tone except the MA-172 (and therefore MA-161). This is due to our present limitation to two levels of control current (i.e., two relays on the control panel). The MA-160 and MA-171 are the only options factory equipped for disabling ACTION-CALL, however the modifications necessary to convert other options to tone are simple. Hopefully, the following table will help clear up some of the questions about Regency Remotes.

OPTION	DESCRIPTION
	CONSOLES
MA-169	Extended Local Remote. Simply extends front panel of transceiver by using multi-conductor cable. A carbon mike is used, so an impedance adapter(MA-177) is needed. Only one MA-177 is needed per system. For tone, lifting the handset will disable the tone squelch by the opening of the cradle switch (obviously, if several MA-169's are paralleled, the cradle switches will have to be wired in series). For frequency control, both transmit and receive may be controlled with the addition of a SPDT switch(MA-174).
MA-170	Standard Console for Twisted Pair D.C. Use. Single current level for PTT, but easily modified for tone use (refer to schematic notes). Modifications to two frequency transmit possible, but not advised. Note: Some units may be missing R3(25K Pot) which is necessary for tone use.
MA-171	Same as MA-170 but has low level current(activated by toggle switch or cradle switch) to disable action-call. High level current gives PTT function.
MA-172	Similar to MA-171 but the two current levels are used differently. Low current level gives PTT + F1 and high current gives PTT + F2. An F1-F2 toggle switch is mounted on the faceplate.
MA-173	Same as MA-170 but with an intercom switch which disables all control currents to allow parallel stations to communicate without keying the transmitter.

OPTION	DESCRIPTION
PANELS AND ACCESSORIES	
MA-177	Lo-Hi Impedance Adapter. For use only in conjunction with MA-169 systems.
MA-174	SPDT Switch for use with MA-169.
MA-178	Single Relay Remote. Standardly used with MA-170 and MA-173 where no ACTION-CALL is used.
MA-179	Similar to MA-178 but has two relays. One relay does not switch at low level current inputs. Low current input opens contacts to disable ACTION-CALL (monitor) and Hi current keys transmitter. Standardly used with MA-171, but can be used with modified MA-170 and MA-173. Additional wiring is also provided for the extra control.
MA-180	Same as MA-179 but Hi and Lo level relays are exchanged so that frequency switch functions can be realized. Used exclusively with the MA-172.
Basic System Kits	
MA-158	MA-169 + MA-177
MA-159	MA-170 + MA-178
MA-160	MA-171 + MA-179
MA-161	MA-172 + MA-180

#### SOME NOTES ON PARALLELING UNITS:

1. Don't forget to connect "Tip to Tip" and "Ring to Ring".
2. Parallel consoles, not panels. Only one panel is needed per system.
3. Audio power is the main limitation in paralleling consoles.
4. "Intercom" units may transmit to an MA-170, MA-171, MA-172 or MA-173.
5. The intercom switch may be added to an MA-170, MA-171 or MA-172 at a later date. A momentary normally open SPST is all that is needed.

## REGENCY REMOTE CONTROL OPTIONS

MA-158, MA-159, MA-160, MA-161 and MA-162

### INTRODUCTION

In the design of two-way radio systems, it is often necessary to locate the base station equipment at some point distant from the dispatcher's location. Control lines are then used between the base location and the dispatcher's location to enable the dispatcher to listen and talk over the base station as if it were located on his desk.

### TERMINOLOGY

The control lines are often referred to as "TELEPHONE CONTROL LINES", or "TELEPHONE LINES". This is because these lines are usually leased from the local telephone company, and because they are identical to the ordinary telephone pairs the telephone company uses to provide service. In the parlance of the telephone companies, these lines are called "PMTS CHANNELS" (standing for "Private Mobile Telephone Systems").

A "PAIR" consists of two wires, twisted about each other, and comprising a complete circuit or "CHANNEL". In the language of telephone men, one of the wires of a pair is called the "TIP", the other wire is called the "RING". If you want to ask a telephone man if he might have transposed the wires of a pair, you would ask him if he is sure the pair is connected "TIP TO TIP" and "RING TO RING".

"REMOTE CONTROL" refers to the type of operation in which the base station is located at a distance from the dispatcher's desk, by means of "TELEPHONE CONTROL LINES". "LOCAL CONTROL" refers to a station that is located within reach of the dispatcher's desk. "EXTENDED LOCAL CONTROL" refers to a station located tens or hundreds of feet from the dispatcher, but is operated by means of a cable having many conductors as opposed to the use of only a single pair of wires used to control a "REMOTE CONTROLLED" station.

At the base station, special circuitry is needed to allow the station to be operated by remote control, this circuitry is called the "REMOTE CONTROL PANEL".

At the dispatcher's location, a piece of equipment containing the amplifiers, loudspeaker, and other circuitry necessary for remote control of the station is necessary. This unit is called the "REMOTE CONTROL CONSOLE".

### CONTROL LINE FUNCTIONS

In the interests of economy, only one pair of "Telephone Control Lines" is used between the "Remote Control Console" and the base station site. This line pair must therefore carry out all the following functions:

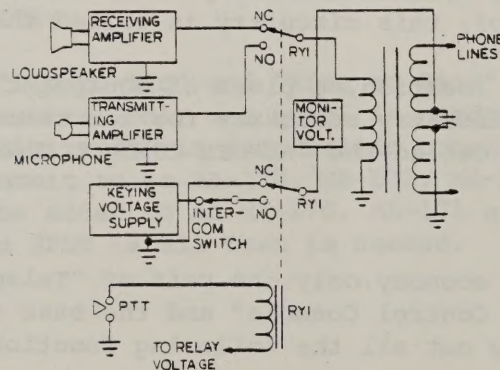
1. Carry the transmitting audio from the Remote Control Console to the base station.

2. Carry the receiving audio from the base station to the Remote Control Console.
3. Turn the base station transmitter on and off as the dispatcher depresses his "Push to Talk" button.
4. Other functions such as switching between frequencies or providing the "Monitor" function for CTCSS (Tone) Systems.

#### REMOTE CONTROL CONSOLE

This outwardly resembles a telephone except for the presence of the PTT Lamp, Volume Control and PTT Button. A Remote Control Console consists of the following (See Figure 1):

1. A receiving amplifier, to amplify the receiving audio from the control line to sufficient power to run a loudspeaker.
2. A transmitting amplifier, to amplify the output of the microphone to sufficient power to send over the control line.
3. A keying voltage source, for the purpose of providing a DC control voltage which is impressed on the line to turn on the transmitter at the remote base station.
4. A switching system, which switches the control line from the receiving amplifier to the transmitting amplifier, and connects the keying voltage supply to the line whenever the "push to talk" button is depressed. Although switching is done with solid state devices in Regency Remote Control Consoles, Figure 1 shows a relay for simplicity.
5. When monitoring or frequency selection is used, another voltage source is put in series with the keying voltage source such that four voltage levels (and thus current levels) are obtained to allow the required combined functions. With the intercom version, the keying voltage is disabled to allow conversation among parallel units.

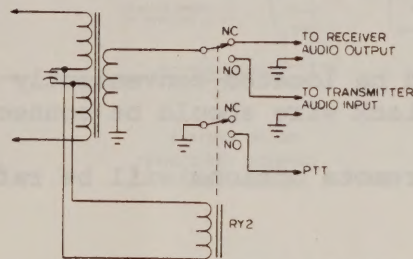


SIMPLIFIED BLOCK DIAGRAM OF  
REMOTE CONTROL CONSOLE

FIG. 1

## REMOTE CONTROL PANEL

The remote control panel consists essentially of a line input transformer and a control relay, which is operated by the DC voltage sent out from the Remote Control Console. When actuated, the control relay switches the line input transformer from the audio output of the base station transmitter, and actuates the transmitter keying relay, turning the transmitter on. A block diagram of a simple remote control panel is shown in Figure 2. In frequency selectable or monitor versions, a second relay which closes at a lower current level is placed in series with the PTT relay.

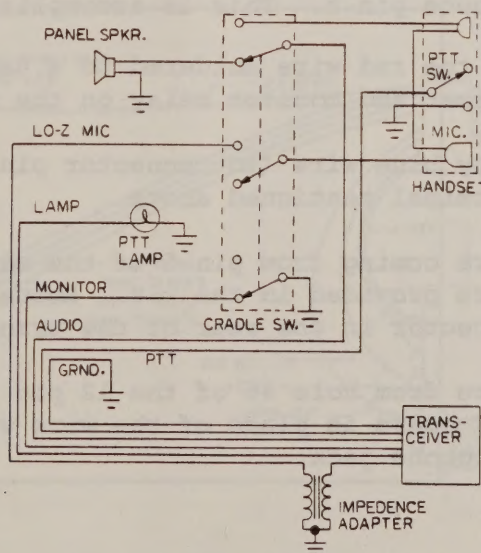


ELEMENTARY DIAGRAM OF  
REMOTE CONTROL PANEL

FIG. 2

## EXTENDED LOCAL REMOTE

Although the extended local remote looks similar to the standard remote control console, it is for all practical purposes a remotely located front panel and microphone for the base transceiver. Microphone audio, however, is transferred on a high current level, low impedance line to minimize hum and noise. As a result of this, an impedance adapter is necessary to match this line to the transmit audio amplifier as shown in Figure 3.



SIMPLIFIED DIAGRAM OF AN  
EXTENDED LOCAL REMOTE  
CONTROL SYSTEM

FIG. 3

## INSTALLATION

### General

Regency remote control panels are mounted external to the transceiver and electrically connected through a short cable to the rear twelve pin connector. Harness wire and pins are provided for connections from the rear connector to the necessary points inside the transceiver. Most connections are parallel with the mike jack. Caution must be taken when paralleling units to see that control voltages are of the same polarity. Connect the twisted pair to terminals 1 and 2 of the panel.

The remote console should be located conveniently and the red and white wires connected to the pair. The black wire should be connected to a solid earth ground.

From this point forward remote options will be referred to by the following numbers:

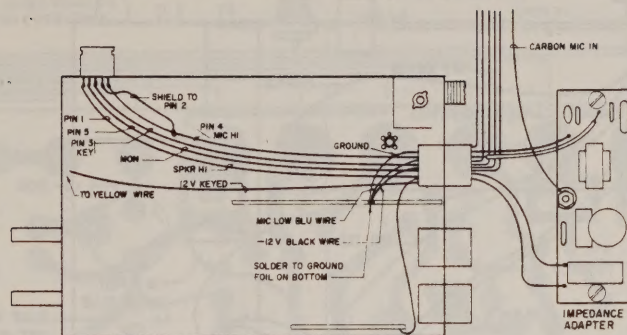
MA-159	Standard Remote Control System
MA-160	Remote Control With Tone Monitor
MA-161	Remote Control With Frequency Selection
MA-162	Remote Control With Intercom Switch
MA-158	Extended Local Remote

### Specific Installations

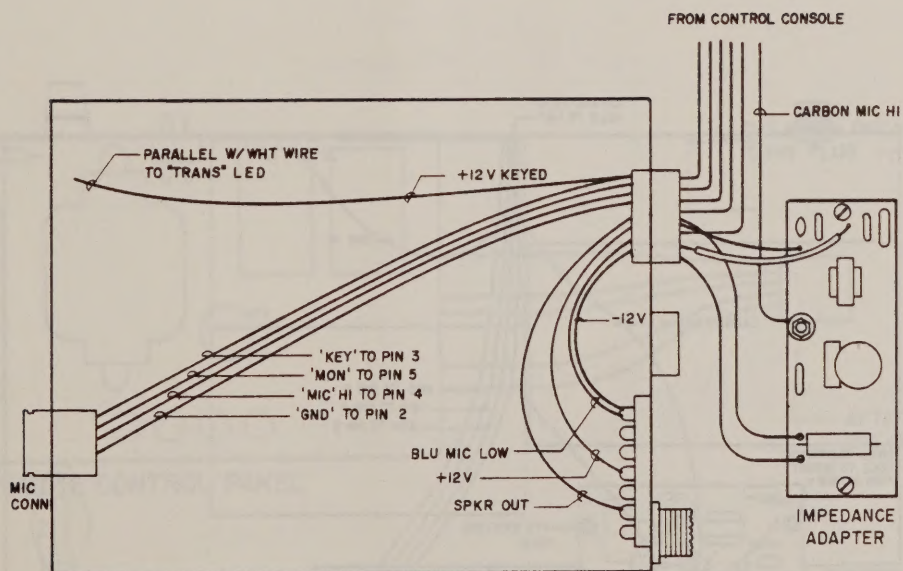
Refer to illustrations on the following pages. MA-161 connections are identical to MA-160 connections except pins 5 and 6 are used for grounded crystal switching.

NOTE: If it is desired to use the MA-160 in conjunction with a desk microphone, the monitor function will operate correctly only if the monitor relay is in series with microphone pin 5. This is accomplished as follows:

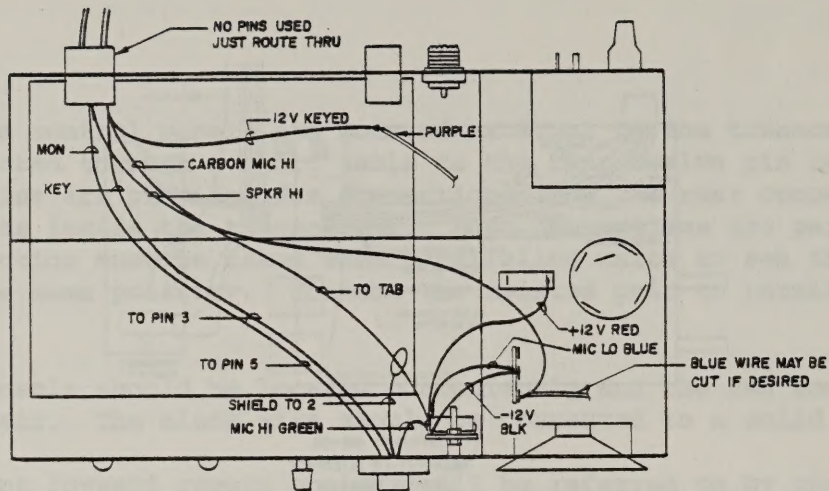
1. Locate and remove the red wire soldered to a terminal located between the audio transformer and monitor relay on the remote control panel.
2. Unsolder the nearby blue wire (to connector pin 6) and resolder it to the now unused terminal mentioned above.
3. Disconnect the wire coming from pin 5 of the mike jack. Replace it with the green wire provided in the kit. Route this wire to hole #5 of the 12 pin connector in the rear of the transceiver.
4. Route the blue wire from hole #6 of the 12 pin connector and solder it in the receiver PC board in place of the wire which originally came from pin 5 of the microphone jack.



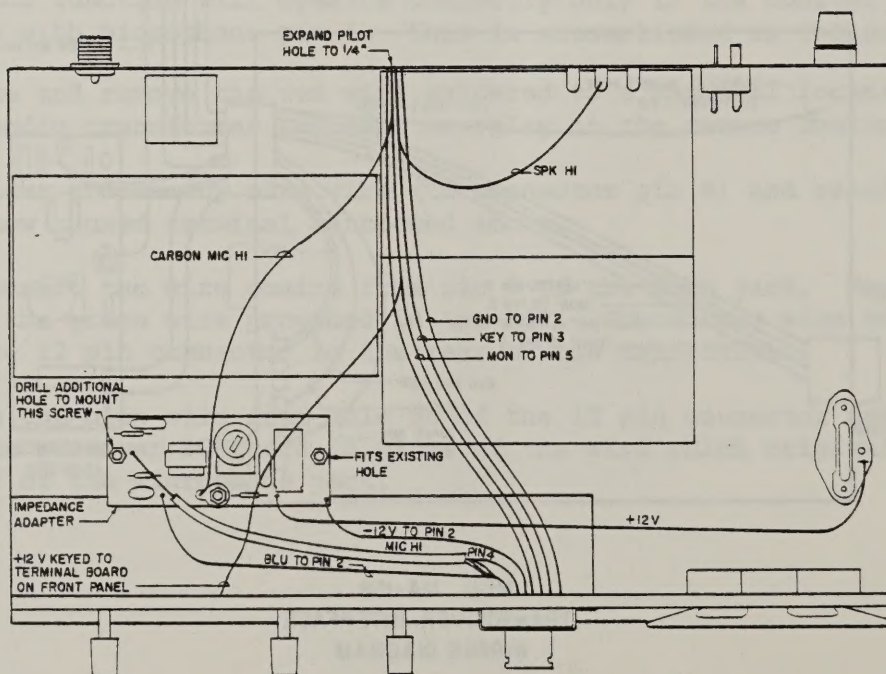
8TH/MCV MA-158  
TRANSCIVER INTERFACE  
WIRING DIAGRAM



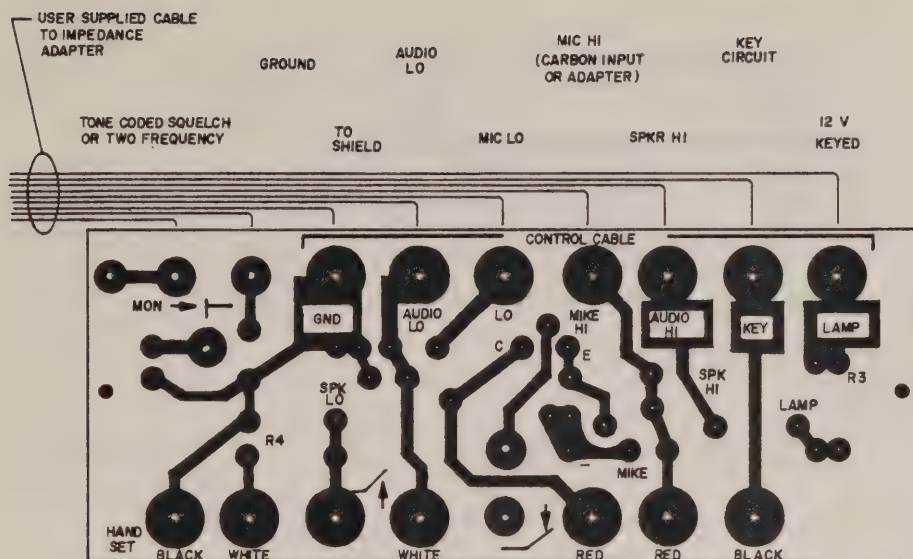
MCU MA-158  
TRANSCIVER INTERFACE  
WIRING DIAGRAM



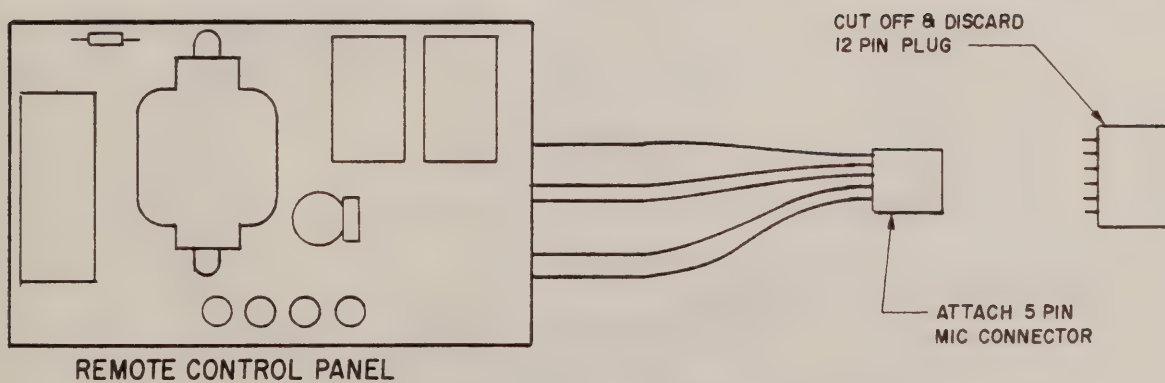
MCU B MA-158  
TRANSCEIVER INTERFACE  
WIRING DIAGRAM



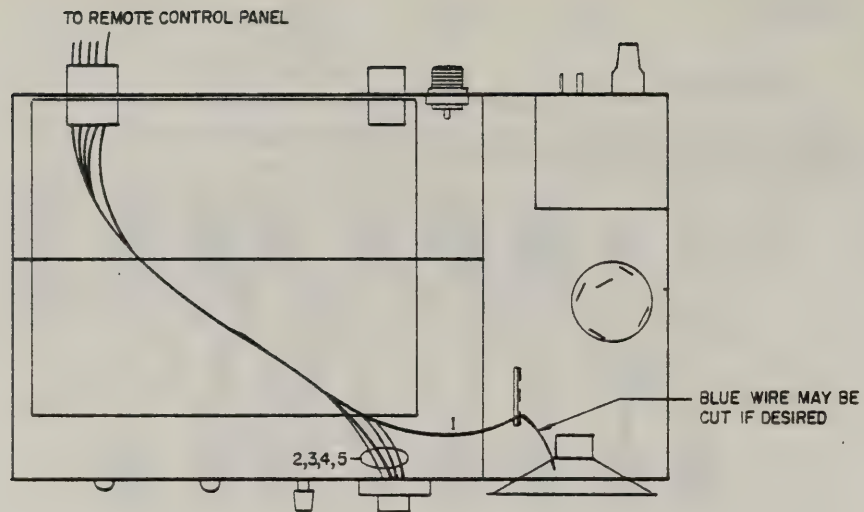
BTH/BASE MA-158  
TRANSCEIVER INTERFACE  
WIRING DIAGRAM



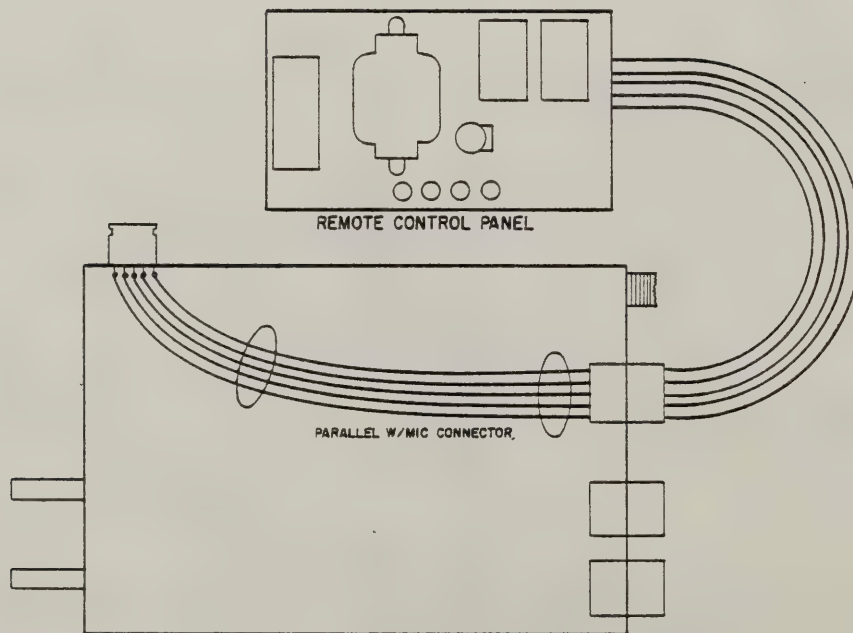
MA-158  
CONSOLE CONNECTIONS



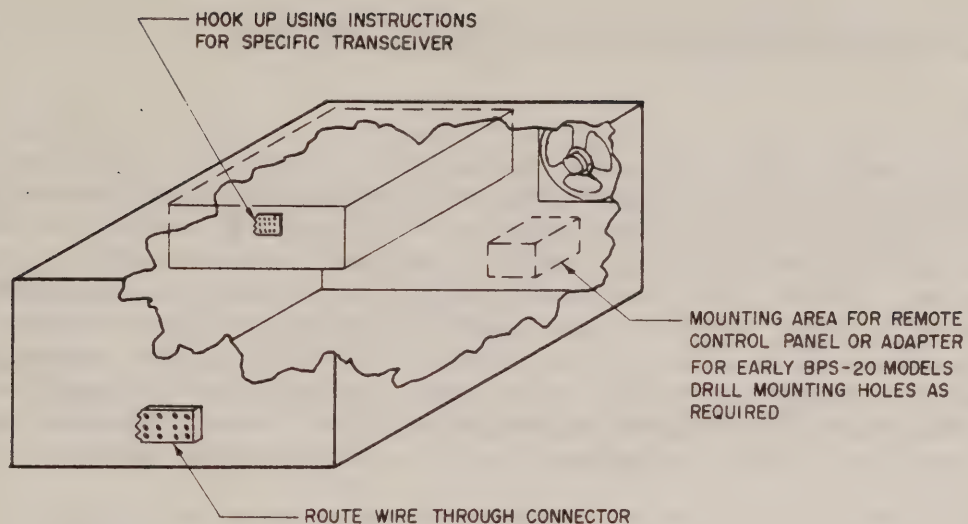
BTL MOBILES, BTH BASE  
MA-159, MA-160, MA-162



MCU B  
MA-159, MA-160, MA-162  
TRANSCIVER INTERFACE  
WIRING DIAGRAM



BTH/MCU/MCV  
MA-159, MA-160, MA-162



BPS-20 MOUNTING DIAGRAM

MA-158

GND TO	G
+12 V KEYED TO	P2
SPKR HI TO	A7 A8 OR A9
MON TO	K5
KEY TO	C5
MIC HI TO	U1
+12 V TO	P1
-12 V TO	G
MIC LO TO	G

MA-159, 160, 162

1. A7 A8 OR A9
2. G
3. C5
4. U1
5. K5

REAR CONNECTOR  
PIN NOS.

MA-161

1. A7 A8 OR A9
2. G
3. C5
4. U1
5. C0 & K0
6. C1 & K1

REMOVE JUMPER FROM  
C4 TO G

FOR PHYSICAL LOCATION OF IMPEDANCE ADAPTER OR  
REMOTE CONTROL PANEL SEE MCU DRAWINGS

**MCL, MCH, MCU  
CONNECTIONS**

## ADJUSTMENT PROCEDURE FOR MA-159, MA-160, MA-161, MA-162

### Line Input

With the remote unit properly terminated to telephone lines, open the base station receiver squelch and adjust the level as measured across the terminated telephone lines at the receiver for plus 12 DBM (3.3 VAC) or maximum level permitted by the telephone company. Set the volume control to one half of full volume. Reduce the line level control to minimum, wait one second for the compressor circuit to decay, then slowly advance the level control until no increase in volume is realized. The compression level will be approximately 2.4 VAC as measured across the volume pad. After the compression level is reached, the line level should be reduced approximately 1/8th turn. Minimum compression should be used to minimize background and line noise during pauses in transmission.

### Line Output

The line output level is factory set for plus 10 DBM which should give good signal to noise ratio. Set the RF transmitter for correct modulation and adjust the remote panel input control for the same modulation level. If adjustments are made to the line output control, levels in excess of plus 12 DBM should be avoided.

### Control Voltage

Standard control voltage is 100 VDC across a total DC loop resistance of 7,500 ohms. This voltage can be reduced to 45 VDC by removing the jumper across R45; or, it can be varied by means of the control voltage potentiometer R3.

## CIRCUIT ANALYSIS FOR MA-159, MA-160, MA-161, MA-162

### Receive Audio

The input audio path is through transformer T1, input level control R1 and through C20 to the base of preamplifier Q7. Amplifier audio from the collector of Q7 is coupled through C11 to input 2 of the LM380 power amplifier integrated circuit.

The audio output level is sampled by the divider network R33 and R34 and applied to the compressor amplifier Q8. When the preset compressor level is reached, Q8 conducts and charges C19. DC voltage across C19 causes Q5 to conduct which causes the AC impedance of Q6 to be reduced which lowers input audio to Q7.

The speaker level control potentiometer, R52, as well as the earpiece dropping resistor, R21, receives audio through coupling capacitor C15.

### Transmit Audio

R17, R18, and C4 are used to decouple and filter voltage for the microphone element at "B" terminal. When "A" terminal is shorted to common through the PTT switch, Q3 conducts, providing voltage for the transmit IC-2. Q3 also provides bias for Q9 which causes Q6 to conduct which provides receiver muting while in the transmit condition. Q4 is used to provide a fast discharge of the filter capacitor C8 when the unit is switched from transmit to receive.

The output of IC-2 is coupled through C9 to the low impedance transformer tap of T1.

#### Surge Protection

R22, R23 and SG1 are used to provide protection from high voltage surges on the telephone lines. R22 and R23 act as fuses when extremely high voltage surges are received. R24 and CR10 through CR15 are used to provide surge protection for pin 8 of IC-2.

#### DC Control Voltage

Q1 and Q2 are used to switch the voltage on for tone squelch disable and transmit key.

In the standby condition transistor switch Q1 causes the base voltage supply to Q2 to be shorted at the junction of R6 and R9. With no base voltage transistor switch Q2 is turned off so that key voltage is not present at (3).

When the PTT is pressed, switch Q1 is turned off which causes high voltage through R6 and R9 to turn Q2 on which places key voltage on the line. Line key voltage will be approximately the voltage at the base of Q2.

When current controlled tone squelch disable is used, base voltage to Q2 is supplied through R7, cradle contacts (G) and (H), R4 and R3. Q2 base and R6 to common through Q1 form a voltage divider with voltage controlled by R3. When the PTT is pressed, Q2 base also receives voltage through R7 and R9 which causes emitter voltage to increase to the full power voltage.

#### ADJUSTMENT PROCEDURE FOR MA-158

##### Modulation

Set R1 of the impedance adapter to mid range and adjust the deviation control per transceiver instructions.

##### Audio Output

Volume control should be opened fully. Transceiver speaker may be disconnected if desired.

# VOLTAGE & RESISTANCE

MA-159, 160, 161, 162

All measurements made with unit terminated into 600 ohm line with line-to-line keying with 7500 ohm total line resistance. Modulation control is set for maximum with signal generator adjusted for +10 DBM output. Receiver measurements are made at threshold of compression and with 20 DB of compression 1000 Hz. Input control is set for maximum sensitivity and signal generator is adjusted as required.

## VOLTAGE & RESISTANCE

MA-159, 160, 161, 162

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		RESISTANCE	RECEIVE LEVEL AT THRESHOLD OF COMPRESSION	RECEIVE LEVEL SET FOR 20 DB OF COMPRESSION	TRANSMIT LEVEL SET FOR +10 DBM	NO SIGNAL
T1	BK-GN	12Ω				
	Y-BR	12Ω				
	R-BL	20Ω	-9DB			
	V-BL	7.5Ω			+1DB	
T2	BK-Y	150Ω				118ac
	RD-RD	1300Ω				225ac
	GN-GN	5.5Ω				13.3ac
Q1	C	35K	.2dc		115dc	
	B	100K	.56dc		.45dc	
Q2	E	45K	0		113dc	
	C	5K	144dc		123dc	
	B	28K	0		113dc	
Q3	E	1K	15.5dc		14dc	
	C	5K	0		14dc	
	B	12K	15.6dc		0	
Q4	C	5K	.01dc		13.9dc	
	B	100K	.620dc		.53dc	
Q5	E	2K	.5dc	.58dc	12dc	
	C	2K	15.6dc	14.6dc	14dc	
	B	8K	1.09dc	1.1dc		
Q6	C	4.3K	-54DB .009dc	.07dc	.2dc	
	B	2K	.95dc	.58dc	.85dc	
Q7	C	5K	-21DB 4.4dc			
	B	30K	.6dc			
Q8	E	8K	1.05dc	1.14dc		
	C	5K	15.2dc	14.6dc		
	B	5K	.52dc	.6dc		
Q9	E	1.4K	.45dc		121dc	
	C	2K	15.6dc		14.2dc	
	B	20K	0		12.8dc	
IC1	1	20K	7.7dc			8.6dc
	2	7K	-24.5DB			
	6	7K				
	8	5.5K	+10DB 7.7dc			8.8dc
	14	4.5K	15.5dc			17.2dc
IC2	1	25K			7dc	
	2	6K				
	6	6.5K				
	8		0		5.6dc	0
	14	5K			14.1dc	0

## KIT CONTENTS

### MA-158

1. Extended Local Remote Console
2. Lo to Hi Impedance Adapter

### MA-159

1. Standard Remote Control Console
2. Standard Remote Control Panel
3. Four 17-inch Long Solid Conductor Insulated Wires Terminated with Female Connector Pins

### MA-160

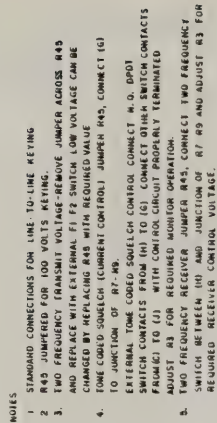
1. Remote Control Console with Monitor Switch
2. Two Function Remote Control Panel
3. Six 17-inch Long Solid Conductor Insulated Wires Terminated with Female Connector Pins

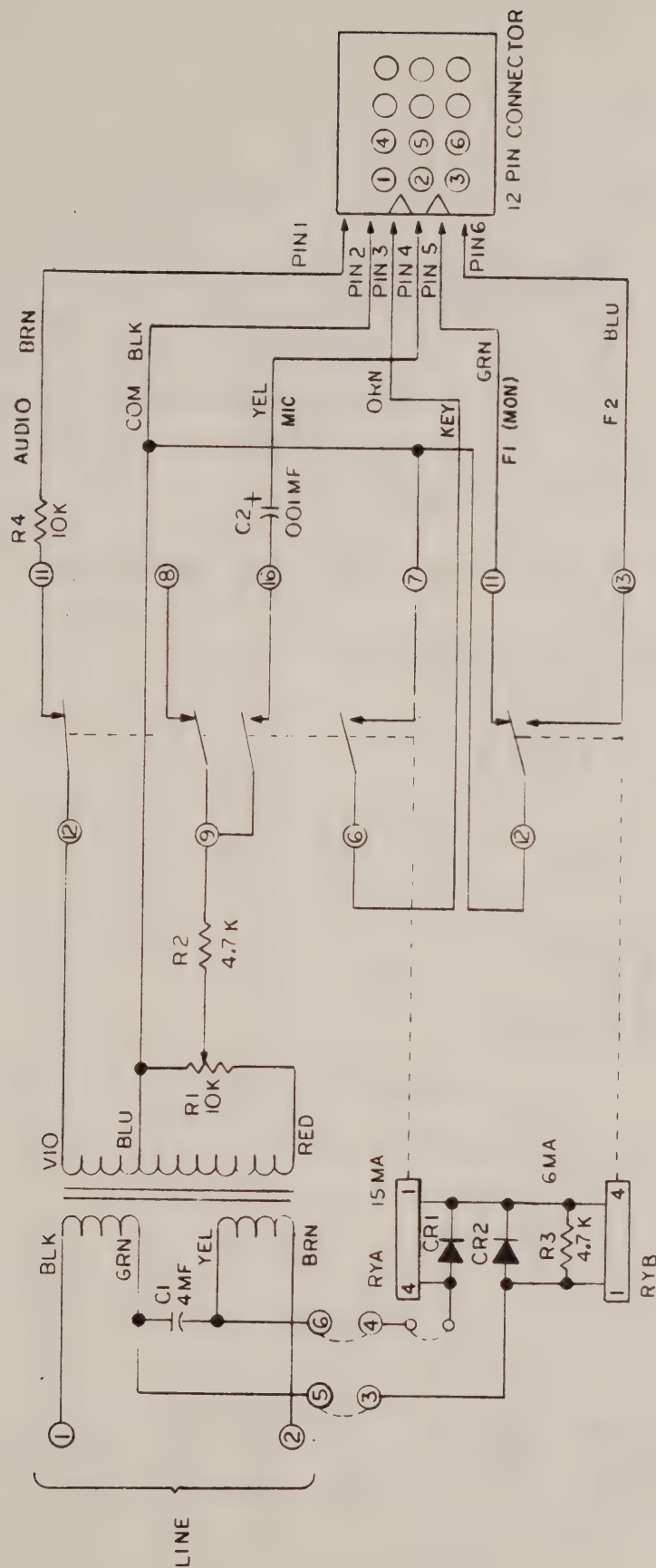
### MA-161

1. Remote Control Console with Frequency Switch
2. Two Function Remote Control Panel
3. Six 17-inch Long Solid Conductor Insulated Wires Terminated with Female Connector Pins

### MA-162

1. Remote Control Console with Intercom Switch
2. Standard Remote Control Panel
3. Four 17-inch Long Solid Conductor Insulated Wires Terminated with Female Connector Pins

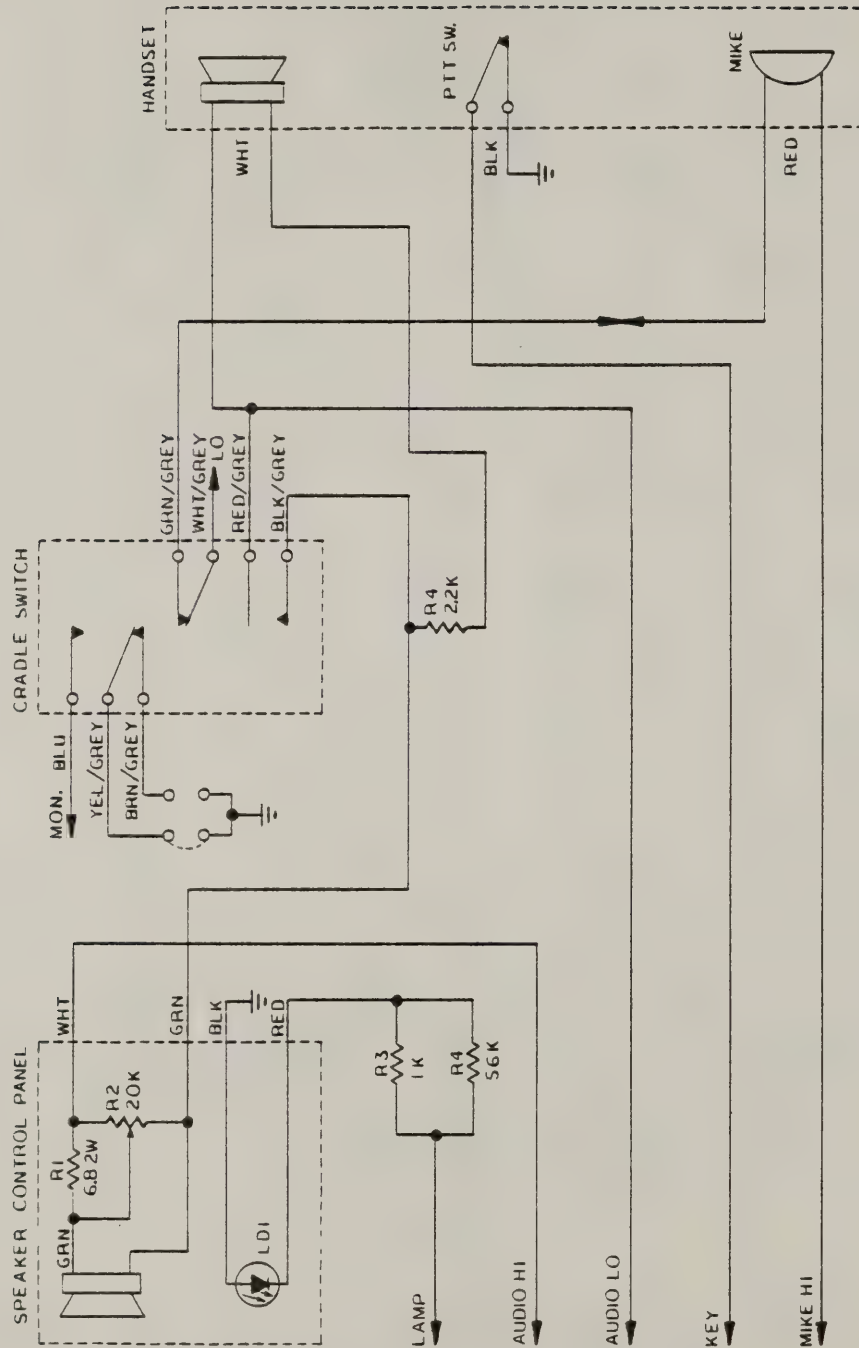




NOTES:

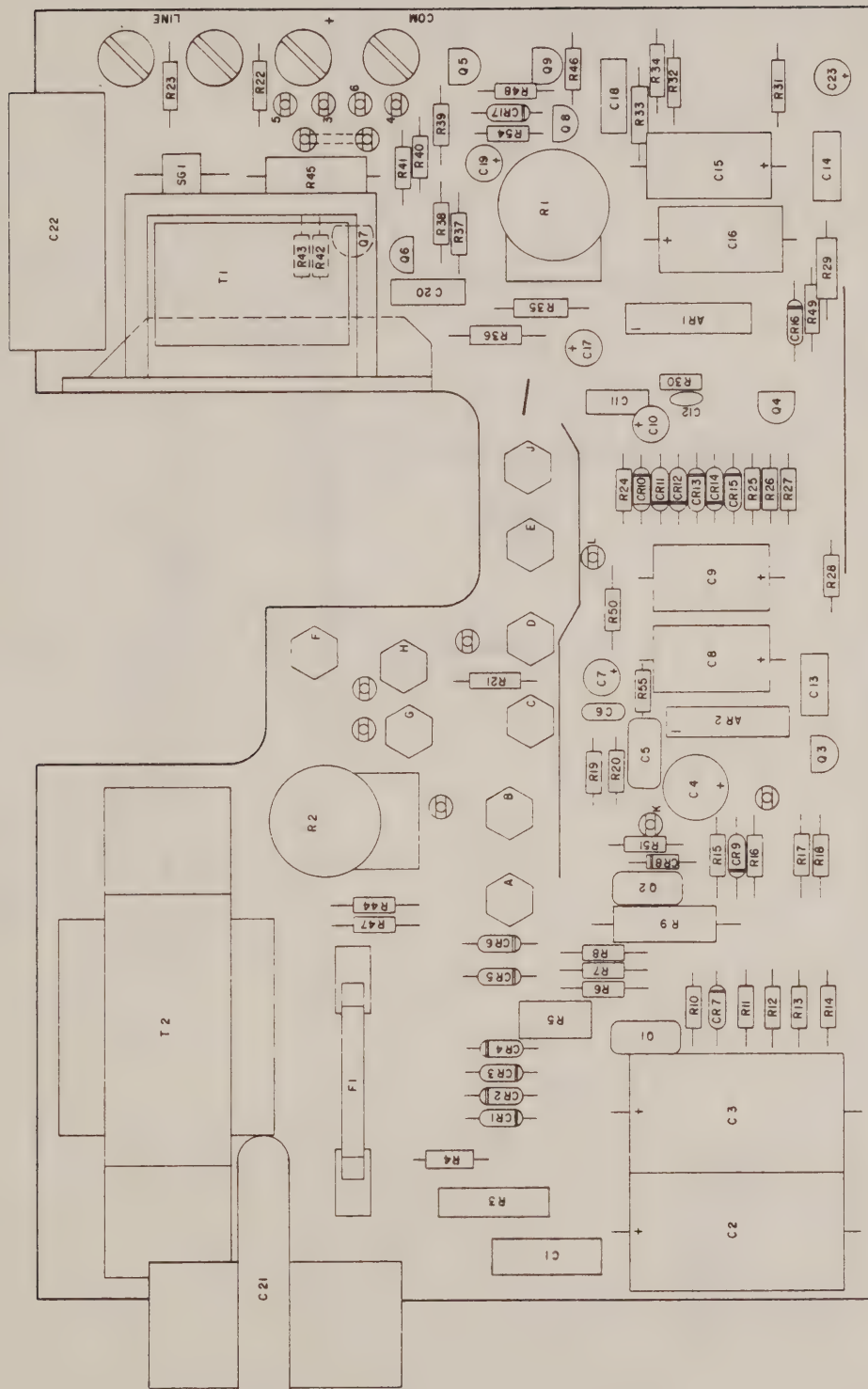
1. RYB USED ONLY WITH MA 160, MA 161.
2. IF MA 160 IS USED WITH EXT. BASE MIKE, PIN 12 IS REMOVED FROM COMMON LINE AND BLUE LINE TO CONNECTOR PIN 6 IS SHIFTED TO PIN 12 OF RYB.

MA-159, MA-160, MA-161, MA-162  
REMOTE CONTROL PANEL



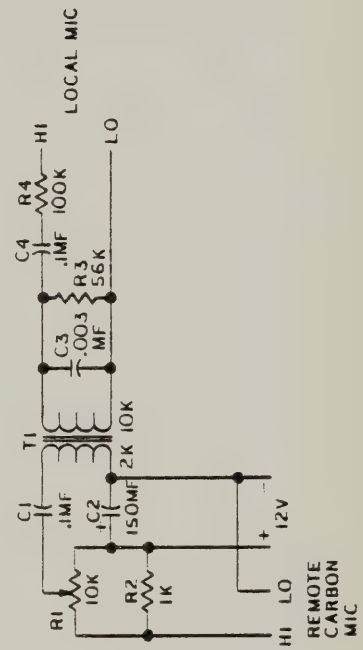
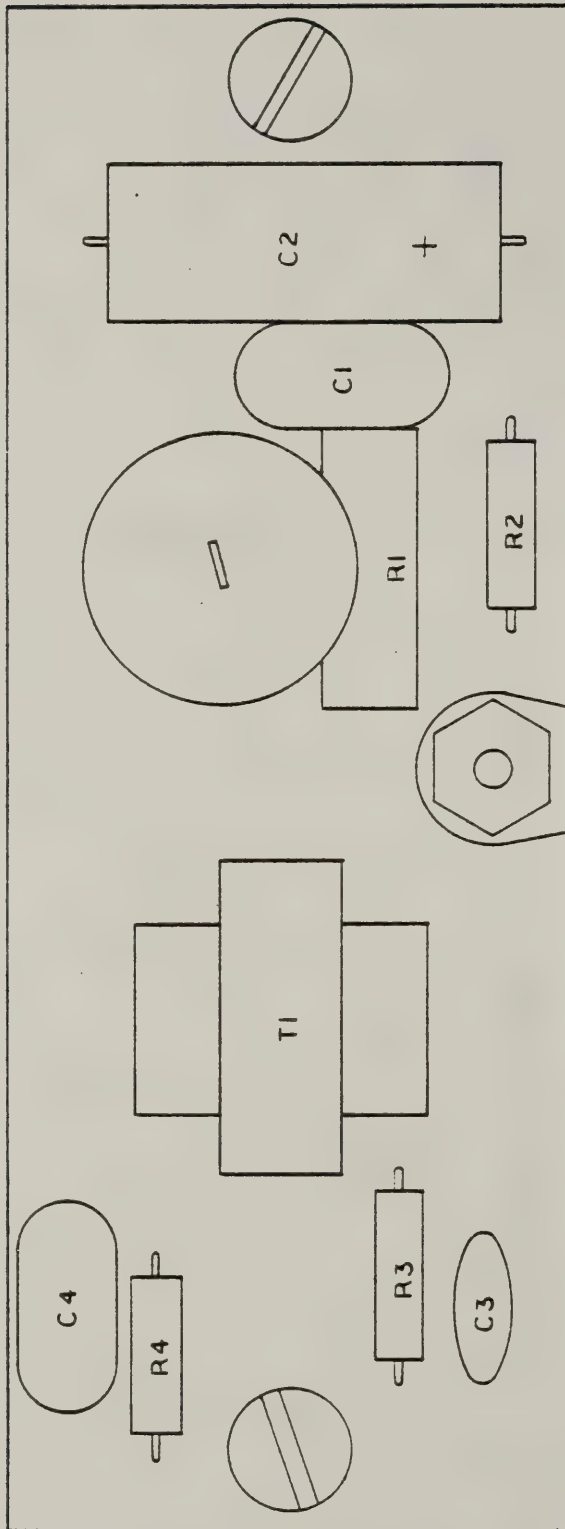
NOTES  
 1. 707 - CARBON MIKE  
 705 - TRANSISTORIZED  
 704 - DYNAMIC

MA-158  
 REMOTE CONTROL CONSOLE



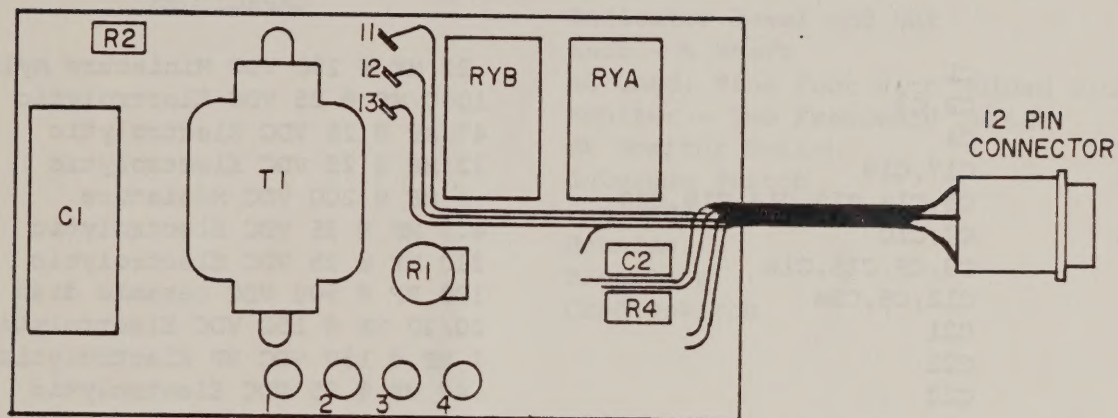
PARTS PLACEMENT  
 MA-159, MA-160, MA-161, MA-162  
 CONSOLE

708



MA-158

PARTS PLACEMENT & SCHEMATIC



REMOTE CONTROL PANEL

# PARTS LIST

MA-159, 160, 161, 162

## SYMBOL

## DESCRIPTION

### CAPACITORS

C1	.22 MF @ 250 VDC Miniature Mylar
C2,C3	1000 MF @ 25 VDC Electrolytic
C4	47 MF @ 25 VDC Electrolytic
C17,C19	22 MF @ 25 VDC Electrolytic
C5,C11,C13,C14,C18,C20	.1 MF @ 200 VDC Miniature
C7,C10	4.7 MF @ 35 VDC Electrolytic
C8,C9,C15,C16	220 MF @ 25 VDC Electrolytic
C12,C6,C24	180 PF @ 500 VDC Ceramic disc
C21	20/20 MF @ 150 VDC Electrolytic
C22	4 MF @ 150 VDC NP Electrolytic
C23	.47 MF @ 35 VDC Electrolytic

### DIODES/RECTIFIERS

CR1-CR5,CR9	1 AMP @ 200 VDC Silicon Diode
CR7,CR8,CR10-CR17	50 MA @ 60 VDC Silicon Diode

### TRANSISTORS/INTEGRATED CIRCUITS

Q1,Q2	20 Watt, 300V,NPN
Q3	Small signal,PNP
Q4,Q9	Small signal,NPN
IC1,IC2	National,LM380

### RESISTORS

R1,R2	10K CTS U201 R103B,Potentiometer
R3	25K CTS X201 R253B,Potentiometer
R5,R12,R31,R50,R51	1/2watt,5% Carbon Resistor
R4,R6-R8,R10,R11,R13-R30,R32,R44,R46-R49	1/2watt,5% Carbon Resistor

### TRANSFORMERS

T1	Line Transformer,600/300-16 Ohm
T2	Power Transformer,117 VAC/105-15 Volts

### FUSE

F1	3AG-1/8 Amp,Bussman
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SYMBOLDESCRIPTION

## MISCELLANEOUS

S1	Speaker, 4" Square, 8 Ohm Impedance
R52	Volume Control, 50 Ohm, 5 Watt Wire Wound
R53	1 Watt 20% Carbon Resistor
NE-3	Neon Indicator Lamp
	Grill
	Indicator Jewel and Nut
	Knob - $\frac{1}{4}$ Shaft
	AC Cord, Nine Foot With Molded Plug
	Monitor - Two Frequency Switch
	RP Monitor Switch
	Intercom Switch
	Handset
	Housing
	Baseplate
	Cradleswitch

